TU-546

MOTOROLA test equipment

portable test set

MP MASTER
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68P849845-C

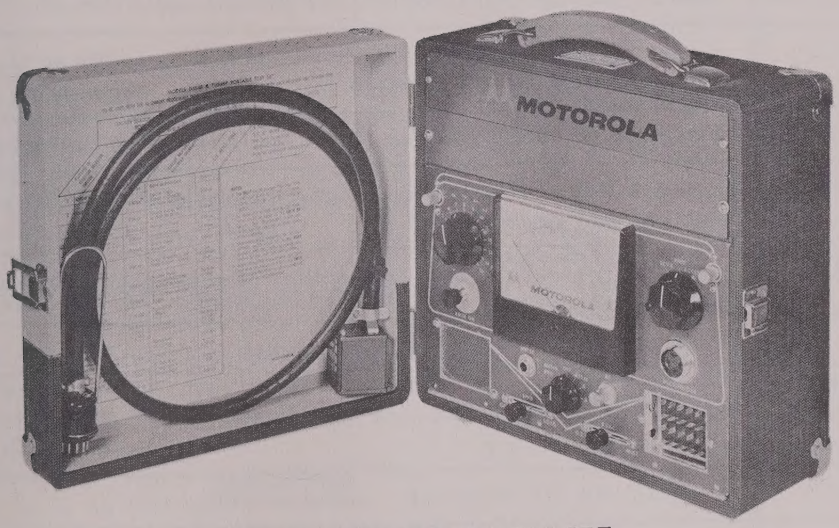
MOTOROLA

PORTABLE TEST SET

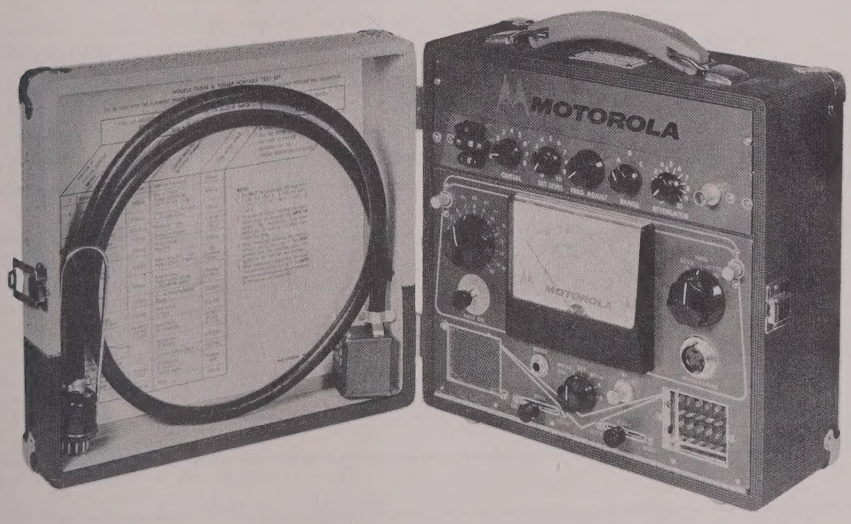
MODELS TU546 & TU546P

CE1701B

CE1701A



TU546 PORTABLE TEST SET



TU546P PORTABLE TEST SET

MOTOROLA INC. COMMUNICATIONS DIVISION

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68P849845
Issue - C

GUARANTEED PERFORMANCE SPECIFICATIONS

PORTABLE TEST SET

MODEL	TU546 Series
ALIGNMENT	metering facilities for alignment of receiver and tune-up of transmitter through a single, 11-pin plug and cable
RECEIVER OUTPUT	accurate measurement of output voltage for receiver quieting measurement. Self-contained PM speaker permits audio reception.
IF PEAKING	transistorized i-f oscillator provides output from 350 kc to 13 mc when used with appropriate crystals
CRYSTAL TESTING	activity of crystals between 350 kc and 13 mc may be checked
FIELD INTENSITY METER	relative values of the r-f field intensity radiated from the transmitter antenna may be measured
RF WATTMETER	accurate measurement of transmitter power output with optional calibrated dummy load
METER	0-50 microamps; 2% full scale accuracy
TRANSISTOR COMPLEMENT AND FUNCTION	(1) oscillator (2) AC voltmeter ampl.
POWER SUPPLY	4 1-1/2 volt "D" batteries
AC VOLTMETER	accurately measures audio input to transmitter and audio output of receiver Range: 0 to .2 v a-c; 0 to 2 v a-c Frequency Response: ±1 db from 35 cps to 5000 cps Input Impedance: 2 v range 400,000 ohms; .2 v range 40,000 ohms Stability: -1 db from -5°C to +60°C -3 db at -30°C
SIZE	12-1/2" high x 12" wide x 6-1/2" deep
WEIGHT	11 lbs.

PEAKING GENERATOR

MODEL	TK589
FREQUENCY	crystal controlled output from 4 mc through 960 mc
TRANSISTOR COMPLEMENT & FUNCTION	(1) oscillator
POWER SUPPLY	6 v d-c

FOREWORD

INSTRUCTION MANUAL REVISION BULLETINS

Changes which occur after an instruction manual is printed are covered by the Instruction Manual Revision Bulletins. These bulletins give the reader complete information on the change including pertinent parts list data from which the instruction manual can be corrected.

NATIONAL SERVICE ORGANIZATION

Motorola has a nation-wide service organization. Through its maintenance and installation program Motorola makes available the finest service to those desiring reliable continuous communications on a contract basis.

The largest service organization specializing in mobile communications is Motorola's National Service Organization. Over 800 strategically located, adequately staffed and trained, independently owned and operated stations, manned with several thousand FCC Licensed Personnel constitute the sub-contracting force.

The administrative forces of area and district service managers and district service representatives are in the direct employ of Motorola.

For your contract service requirements, please contact your local Motorola representative or write to:

National Service Manager
Motorola Communications Division
4501 W. Augusta Blvd., Chicago 51, Illinois

REPLACEMENT PARTS ORDERING

Motorola maintains parts and service depots in Fair Lawn, New Jersey; Dallas, Texas and Burlingame, California to supplement the activities of the Parts and Service Department in Chicago. The table outlines the services provided by these facilities:

Factory:
Crystal Service Department
916 N. Kilbourn Ave.
Chicago 51, Illinois

Burlingame:
Parts and Service
1616 Rollins Road
Burlingame, California

Chicago:
Parts and Service
4910 West Flournoy St.
Chicago 44, Illinois

Fair Lawn:
Parts and Service
15-00 Pollitt Drive
Fair Lawn, New Jersey

Dallas:
Parts and Service
7138 Envoy Court
Dallas 35, Texas

Area Served	Parts & Service	Crystals	Resonant Reeds
Central Area	Chicago	Factory	Factory
Eastern Area	Fair Lawn	Factory	Factory
Southern Area	Dallas	Factory	Factory
Western Area	Burlingame	Factory	Factory

These offices are fully equipped to give this service. When ordering replacement parts, the complete number identification of the item must be used whether it be a component, kit or complete chassis. This will fix proper identification and insure receipt of the desired item. Complete number identification should also be used when requesting equipment information.

Crystal orders should specify crystal frequency, desired test set output frequency and the crystal type number, if known. If the type number is not known, specify that the crystal is for the TU546 Series Portable Test Set or for the TK589 Peaking Generator and the frequency desired.

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Metering Chart EPD-1100
Schematic Diagram and Parts List 63E849846
Simplified Circuit Diagram 63E849842

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1. INTRODUCTION

The Motorola TU546 Portable Test Set provides the metering necessary to align and check Motorola transmitters and receivers in the 25-960 mc frequency range. The type of primary power source used by the communications equipment does not matter.

The test set housing is a convenient carrying case with a removable front cover. Clips mounted in the front cover hold the metering cable when carrying the test set. The accessories supplied with the test set can be stored in the meter protective cover, inside the test set, which is accessible by twisting the two quarter turn screws and opening the front panel.

Operating voltage is taken from an internal 6 volt d-c source consisting of four 1-1/2 volt "D" batteries connected in series.

The test sets incorporate the following performance features:

- Direct reading multi-scale meter
- Transistorized a-c voltmeter
- Transistorized oscillator
- Selection of metering circuits in transmitters and receivers
- Zero center scale
- Peaking generator (included in the Model TU546P only or available as an optional accessory)

2. EQUIPMENT SUMMARY

a. Models Available

The models available are the basic Model TU546 and the TU546P. The difference between the two models is that the TU546P includes a separate peaking generator, which is mounted in the same carrying case as the test set. A basic model plus a Model TK589 Peaking Generator forms the Model TU546P Portable Test Set.

The TK589 Peaking Generator is also available as a separate item. The basic model test set has provisions for mounting the peaking generator. The TK589 Peaking Generator is fully described in a separate PEAKING GENERATOR section of this instruction manual.

b. Accessories Supplied

Both models include a metering cable, a 455 kc crystal, an r-f probe, r-f probe extension cable, r-f probe adapter and an accessory cable.

The metering cable has a 20-pin connector which mates with the receptacle on the test set and an 11-pin connector to plug into the meter receptacle on the receiver or transmitter being tested.

The 455 kc crystal is used for receiver i-f alignment. It plugs into a socket inside the test set.

The r-f probe is a shielded cable with a connector at one end which mates directly with the BNC connector on the r-f probe extension cable. The extension cable mates with the r-f connector on the test set to supply the required r-f for specific testing purposes.

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The r-f probe adapter is used with the r-f extension cable to permit the cable to connect directly to the antenna receptacle on the radio set for the r-f source.

The accessory cable is described in paragraph 4e.

3. METERING FACILITIES

The test set meter is calibrated in six different scales. Metering Chart (EPD-1100), which is included with this instruction manual, indicates every meter scale and its application. This chart is largely self-explanatory; however, certain procedures cannot be fully explained on the chart and are described in text form under the RECEIVER METERING PROCEDURES and TRANSMITTER METERING PROCEDURES paragraphs of this instruction manual. All metering not explained in the text can be accomplished by following the metering chart and the alignment procedures described in the instructions supplied with the equipment being tested.

In a receiver, the following stages can be measured: last i-f grid, first limiter grid, second limiter grid, discriminator output, oscillator grid, first oscillator multiplier (450-470 mc and 890-960 mc equipment), second oscillator multiplier (450-470 mc and 890-960 mc equipment), B+ voltage, A+ or filament voltage and audio output.

In a transmitter, the following stages can be measured: multiplier grids, driver grid, final amplifier grid, PA plate current, relative r-f power output (450-470 mc and 890-960 mc equipment), B+ (highest B+ to final amplifier stage), push-to-talk relay voltage, audio input and microphone d-c voltage.

Other measurements which can be made are: internal batteries of the test set, r-f voltage from the i-f oscillator and relative field strength.

The meter scales and applications are as follows:

a. 20 - 0 - 20 ua Scale

The 20 - 0 - 20 ua scale is the top scale on the meter. The "0" center feature of this scale provides direct, accurate readings, both positive and negative, without switching meter polarity. This arrangement simplifies adjustment of receiver discriminator output and improves local oscillator tuning for exact "on-frequency" readings.

b. 0 - 50 ua Scale

The 0 - 50 ua scale is the second scale from the top of the meter. This scale is used for most of the transmitter and receiver alignment requirements. The metering chart indicates the various applications for which this scale is used.

c. 0 - 1000 Volt D-C Scale

The 0 - 1000 volt d-c scale is the third scale from the top of the meter. This scale is used primarily for reading B+ voltages in transmitters and receivers.

d. 0 - 15 Volt D-C Scale

The 0 - 15 volt d-c scale is the fourth scale from the top of the meter. This scale is used when measuring filament and relay voltages and also the internal power supply of the test set.

e. 0 - 30 Volt D-C Scale

The 0 - 30 volt d-c scale is the fifth scale from the top of the meter. This scale is used primarily for measuring microphone d-c voltage.

f. 0 - 2 Volt A-C Scale (0 - .2 Volt A-C)

The 0 - 2 volt a-c scale is the bottom scale on the meter. This scale is used to measure the audio output of a receiver and the audio input of a transmitter. The meter sensitivity can be changed, by means of a switch on the front of the test set, to indicate a full scale reading of 0.2 volts a-c.

4. CONTROLS

All controls used for testing and aligning are located on the front panel of the test set. These controls are shown on the Controls Location Detail, number EPD-1116, which is included in this instruction manual, and are as follows:

a. Position Selector Switch

The position selector switch is a 15-position switch used to select the circuit to be metered. The correct switch positions are determined by the type of equipment being tested. The Metering Chart, EPD-1100, included in this manual, indicates the switch positions in relation to the

circuits. Refer to the instruction manual supplied with the radio set for switch positions to be used.

All instruction manuals supplied with Motorola equipment, prior to the publication of this instruction manual, include alignment procedures utilizing a Motorola Model P-8500 or P-8501 series Portable Test Set. The following chart shows the relationship between the position selector switch positions of the P-8500 and P-8501 series to those of the TU546 series Portable Test Sets. An asterisk in the chart indicates there is no switch position on the P-8500 and P-8501 series comparable to the TU546 Series.

RECEIVER	P-8500 & P-8501 series	1	2	3	+4, -4	5	6	-4 (see note)	5 (see note)	7	*	8	*	*	*	*
	TU546 series	1	2	3	4	5	6	7 PA	8 PO	B+ 9	A+ 10	Audio 11	12	13	14	15
TRANSMITTER	P-8500 & P-8501 series	1	2	3	-4	5	6	+4	1	7	8	*	*	*	*	*
	TU546 series	1	2	3	4	5	6	7 PA	8 PO	B+ 9	A+ 10	Audio 11	12	13	14	15

Note: The K-9326 Adapter Plug must be used.

b. Function Selector Switch

The function selector switch is labeled RCVR - XMTR - ACCESS. The RCVR position means receiver and the switch should be placed in this position when metering a receiver. The XMTR position means transmitter and the switch should be placed in this position when metering a transmitter. The ACCESS. position means accessories and the switch should be placed in this position when metering accessory equipment.

c. XMTR ON Switch

The XMTR ON switch is used when measuring transmitter power amplifier (PA) current. Transmitter PA current can be measured only by pressing the XMTR ON switch and not by operating the push-to-talk button on a microphone connected to the test set.

d. SPKR Switch

The SPKR switch is labeled OPEN - SPKR - LOAD. In the OPEN position, a 30 ohm load is placed across the receiver output. In this position, the speaker on the test set is in operating condition, at reduced level, and messages can be heard. The main function of this switch position is to set the GAIN control on a receiver from the trunk of an automobile without double-loading the receiver output. In the SPKR position, which is the normal position of the switch, the speaker on the test set is in operating condition and messages can be heard. In the LOAD position a 3 ohm resistive load is placed across the receiver audio output, which disables the test set speaker.

e. METER Phone Jack

The accessory cable supplied is used when metering certain types of Motorola equipment. The red plug on the cable mates with the METER receptacle on the test set; the black plug mates with the phone-jack on the receiver or transmitter being metered. Motorola equipment with a phone-jack metering receptacle has a switch on the receiver and transmitter chassis to select the circuit to be metered. The accessory cable is also used for measuring transmitter r-f power output with the P-7208 Series Dummy Load.

f. Oscillator and Metering Reversing Switch

The oscillator and meter reversing switch is labeled METER REV - OFF - 455 kc - A - B.

The METER REV position is used to reverse the polarity of the meter to provide an on-scale reading when the needle tends to indicate in the negative direction past zero.

The OFF position is the normal position used for most applications of the test set. If the switch

is in the METER REV position and then placed in the OFF position, the polarity of the meter will be reversed.

In the 455 kc position, a signal of 455 kc is generated by the test set. This signal is used for measuring the grid of the last i-f amplifier and the discriminator input of a receiver. A 455 kc crystal is supplied with the test set.

The A and B positions are also used for crystal selection. Position A selects the crystal inserted in the "A" terminals of the crystal socket in the test set. Position B selects the crystal inserted in the "B" terminals of the crystal socket in the test set. The oscillator in the test set is capable of operation up to 12 mc. Normally, the three crystals used will be 455 kc, 5.5 mc and 12 mc. These crystals will cover the three most commonly used i-f frequencies.

g. RF Connector

The output of the test set r-f oscillator is available at the r-f connector. The r-f extension cable mates directly with the RF connector. The extension cable is used to couple the signal into the antenna connector of the receiver under test. The probe is used to inject the signal into the various stages of the receiver, as required by the alignment procedure.

h. Multiplier Switch

The multiplier switch is labeled 0.2 VAC - 2 VAC - MULT.

The 2 VAC position is the normal position of the switch. The 0.2 VAC and the 2 VAC refer to the bottom scale of the test set meter. Normally the scale reads 2 volts a-c full scale. If the switch is placed in the 0.2 VAC position, the sensitivity of the meter will be increased 20 db and the scale will be 0.2 volts a-c full scale.

The MULT position is used only when measuring the oscillator multipliers in 450-470 mc and 890-960 mc equipment.

CAUTION

DO NOT use the MULT. position for metering 25-54, 72-76 or 132-174 mc receivers. These receivers do not have oscillator multipliers; the meter could be damaged in the MULT. position with these receivers.

i. MICROPHONE Connector

The MICROPHONE connector is a four-pin female receptacle which mates directly with any Motorola microphone (or equivalent) which has a four-pin male microphone connector.

j. Metering Socket

The metering socket is a 20-pin male plug. The metering cable, supplied with the test set, connects directly to the metering socket.

k. Speaker

The speaker is used for all applications which may require audible indications for adjustment or checking purposes.

5. RECEIVER METERING PROCEDURES

Most Motorola FM communications receivers incorporate either an 11-pin metering plug or a phone-jack mounted on the receiver chassis. Receivers which do not have the meter plug or phone-jack have no special facilities for metering purposes. When measuring the latter type of receivers refer to the alignment chart supplied with the receiver.

NOTE

The 20-pin metering cable plug acts as the internal battery ON-OFF switch. Pins 19 and 20 on the plug are jumpered. Connecting the plug to the test set socket completes the battery circuit. To conserve battery life when not using the test set either (1) disconnect meter cable from test set, or (2) set the Oscillator and Meter Reversing Switch to OFF and put Position Selector Switch to any position except 11 or 13.

a. Receivers Incorporating an 11-pin Metering Plug

The Metering Chart, EPD-1100, included in this instruction manual, lists all of the stages which can be measured in a receiver incorporating an 11-pin metering socket. As an example, with the Position Selector Switch in position 1, the procedure is as follows:

(1) Last I-F Stage Alignment

The circuit to be metered is the grid of the last i-f stage. When the metering cable is plugged into the socket on the front panel, the

meter is connected across pins #1 and #11 on the 20-pin plug and pins #1 and #11 on the 11-pin plug of the metering cable. At the same time a resistance of 18,000 ohms, in the test set, is placed in series with the meter. The scale to read is the 0-50 ua scale.

The crystal oscillator in the TU546 Portable Test Set is used to align receiver i-f sections ranging from 350 kc to 13 mc. The crystal employed must have the same frequency or subharmonic of the i-f section being aligned. The frequency of the crystal must be calculated from the formulas given in Table 1. Three internal sockets are available to plug-in the AQL, ANL, and/or AUL type crystals, within the frequency range specified above.

A 455 kc crystal is supplied with the equipment. Other crystals must be ordered separately. Table 2 lists the frequency ranges of different types of available crystals. Having calculated the crystal frequency needed, the crystal type number may be selected from this table. When ordering, specify both the crystal frequency and crystal type number. Refer to the receiver block diagram supplied with the receiver for the i-f frequencies required for alignment.

TABLE 1

Crystal Calculations for TU546 Portable Test Set

Fc = Desired test set output frequency
Fx = Crystal frequency required

Fc	Fx
290-800 kc	$Fx = Fc$
800-1600 kc	$Fx = \frac{Fc}{2}$
1600-2000 kc	$Fx = \frac{Fc}{3}$
2-13 mc	$Fx = Fc$

TABLE 2

Crystal Type Available and Their Frequency Range

Crystal Frequency	Motorola Type
290-800 kc	AQL
1250-1600 kc	ANL and AN
2000-6000 kc	ANL and AN
6000-10000 kc	AUL
10000-13000 kc	ANL and AN

To align the i-f section of a receiver:

(a) Plug the applicable i-f test crystal into the "A" terminals on the crystal socket inside the test set.

(b) Plug the metering cable into the 20-pin socket on the test set.

(c) Plug the other end of the metering cable into the 11-pin plug on the receiver chassis.

(d) Connect one end of the r-f probe extension cable to the r-f connector on the test set. Connect the other end of the r-f probe extension cable to the r-f probe cable. Place the r-f probe under the receiver chassis near the grid of the last mixer tube.

(e) Place the Function Selector Switch in the RCVR position.

(f) Place the Position Selector Switch in position 1.

(g) Align the receiver as described in the instructions supplied with the receiver. Note that the test set Position Selector Switch positions may differ from those in the receiver instructions. Refer to the chart in paragraph 4a. of these instructions for a cross reference between switch positions.

(2) 450-470 mc and 890-960 mc Receivers - Multiplier Grid Current Measurements

(a) Connect the metering plug to the test set and to the receiver.

(b) Place the Function Selector Switch in the RCVR position.

(c) Place the Position Selector Switch in position #7 or #8.

(d) Hold the Multiplier switch in the MULT. position.

Complete, detailed alignment procedures are described in the instructions supplied with the receivers.

NOTE

In some early models of the 450-470 mc receivers, the first oscillator multiplier is wired to pin #7 and the second oscillator multiplier is wired to pin #8 of the 11-pin metering socket on the

receiver chassis. In later models of the 450-470 mc and the 890-960 mc receivers, the first multiplier is wired to pin #6 and the second multiplier is wired to pin #7 of the 11-pin metering socket on the receiver chassis. In the latter case, the MULT switch is used only to measure the second multiplier.

CAUTION

DO NOT use the MULT position when testing receivers which do not have oscillator multipliers, e.g., 25-54 mc, 72-76 mc and 132-174 mc receivers. The 50 ua meter movement can tolerate a 10 times overload which results in 0.5 ma and approximately one volt across the meter. However, with silicon diodes shunting the meter movement, the current required to maintain one volt across the circuit must exceed 10 ma. In the most sensitive meter connection, approximately 200 volts will cause 10 ma to flow in the circuit. The power dissipated by the resistor is approximately two watts. Since the resistor is rated at 1/2 watt, the duration of this type of overload should be limited, to prevent damage to the precision resistor.

b. Receivers Incorporating a Phone-Jack Metering Connector

To measure receivers which have a phone-jack metering connector, the accessory cable (with a phone-plug at each end) must be used. When the phone-plug is connected to the test set METER receptacle, the Function Selector Switch, Position Selector Switch, XMTR ON button, MICROPHONE connector and the Multiplier Switch are removed from the circuitry. The only exception is the zero center, since it is a separate circuit as described in paragraph 7b.

With the phone-plug connected, the 0-50 ua meter movement is the only scale which can be used. The polarity of the meter may be changed by the METER REV switch.

(1) Plug the red phone-plug, on the accessory cable, into the METER socket on the test set.

(2) Plug the black phone-plug on the other end of the accessory cable into the phone-jack meter connector on the receiver to be tested.

(3) Refer to the instructions supplied with the receiver for detailed metering procedures.

6. TRANSMITTER METERING PROCEDURES

Most Motorola FM communications transmitters incorporate either an 11-pin metering plug or a phone-jack mounted on the transmitter chassis. Transmitters which do not have the metering plug or phone-jack have no special facilities for metering purposes. When measuring the latter type of transmitters, refer to the transmitter alignment chart supplied with the transmitter.

a. Transmitters Incorporating an 11-pin Metering Plug

The Metering Chart, EPD-1100, included with this instruction manual, lists all of the stages which can be measured in a transmitter incorporating an 11-pin metering socket. As an example, with the Position Selector Switch in position 2, the procedure is as follows:

The circuit to be metered is the oscillator or tripler in all Motorola transmitters except 25-54 mc and some 132-174 mc transmitters. When the metering cable is plugged into the socket on the front panel, the meter is connected across pins #2 and #11 on the 20-pin plug and pins #2 and #11 on the 11-pin plug of the metering cable. At the same time a resistance of 18,000 ohms, in the test set, is placed in series with the meter. The scale to read is the 0-50 ua scale.

(1) Measurement of Power Amplifier (PA) Plate Current

Measure the PA current as follows:

(a) Connect the metering plug to the test set and to the transmitter.

(b) Place the Function Selector Switch in the XMTR position.

(c) Place the Position Selector Switch in position #7, PA.

(d) Push the XMTR ON switch and hold it down during the testing period.

The scale to read is the 0-50 ua scale. Refer to the instructions supplied with the transmitter to interpolate the microampere reading to milliamperes plate current.

NOTE

For PA readings, the transmitter must be keyed by the XMTR ON button. A PA reading cannot be obtained by keying the transmitter with a microphone push-to-talk switch.

b. Transmitters Incorporating a Phone-Jack Metering Connector

To measure transmitters which have a phone-jack metering connector, the accessory cable (with a phone-plug at each end) must be used. When the phone-plug is connected to the test set METER receptacle, the Function Selector Switch, Position Selector Switch, XMTR ON button, MICROPHONE connector and the Multiplier Switch are removed from the circuitry. The only exception is the zero center, since it is a separate circuit as described in paragraph 7b.

With the phone-plug connected, the 0-50 ua meter movement is the only scale which can be used. The polarity of the meter may be changed by the METER REV switch.

(1) Plug the red phone-plug, on the accessory cable, into the METER socket on the test set.

(2) Plug the black phone-plug on the other end of the accessory cable into the phone-jack meter connector on the transmitter to be tested.

(3) Refer to the instructions supplied with the transmitter for detailed metering procedures.

c. Measurement of Transmitter R-F Power Output

The P-7208 and P-7208A R-F Dummy Loads are available on separate purchase order for use with the test set to measure transmitter r-f power output. The P-7208 has a standing wave ratio of less than 1.2 between 25 mc and 174 mc with a 50 ohm load impedance. The power capabilities of both dummy loads is 25 watts for continuous operation and 60 watts for intermittent operation. The P-7208A is used with Motorola "Handie-Talkie"® FM Radiophone and Pack Sets. It has the same rated capacity as the P-7208 and is calibrated for a full scale reading of 50 ua with 2 watts r-f power.

Measure the r-f power output as follows:

(1) Plug the red phone-plug, on the accessory cable, into the METER socket on the test set.

(2) Plug the black phone-plug, on the accessory cable, into the dummy load.

(3) Connect the transmitter ANT connector to the coaxial connector on the dummy load. Use the r-f extension cable supplied with the test set.

(4) Turn on the transmitter by means of the microphone used with the radio set.

(5) Note the reading on the meter. Refer to the calibration curve supplied with the dummy load to convert the microamperes to watts.

7. MAINTENANCE

a. Service Accessibility

Turn the panel fasteners (one located above the Function Selector Switch and the other is above the Position Selector Switch) one-half turn and pull down for access to the four batteries. Remove the protective cover to expose the circuitry. Refer to the parts location detail photo opposite diagram 63E849846 for location of the various components of the circuit.

b. Zero Center Adjustment

The zero center scale (top scale) is adjusted at the factory for an exact zero meter reading. Due to ageing and battery life, it may be necessary to re-adjust the zero center. This control is located on the left inside of the test set through a hole in the protective cover. Refer to the parts location detail photo opposite diagram 63E849846. Adjust the control as follows:

(1) Place the Function Selector Switch in the RCVR position.

(2) Place the Position Selector Switch in position 4.

(3) Turn the control in the direction which moves the needle toward zero center. When the needle reaches the zero point, the adjustment is completed.

If the adjustment control does not bring the meter to zero center, replace the 1-1/2 volt battery in the zero center circuit.

c. AC Voltmeter Calibration

The voltmeter is calibrated at the factory. If any components in the meter circuitry are replaced, it may be necessary to re-calibrate the meter. The meter calibration control is located on the printed circuit board. Refer to the parts location detail photo opposite diagram 63E849846 for location of the control.

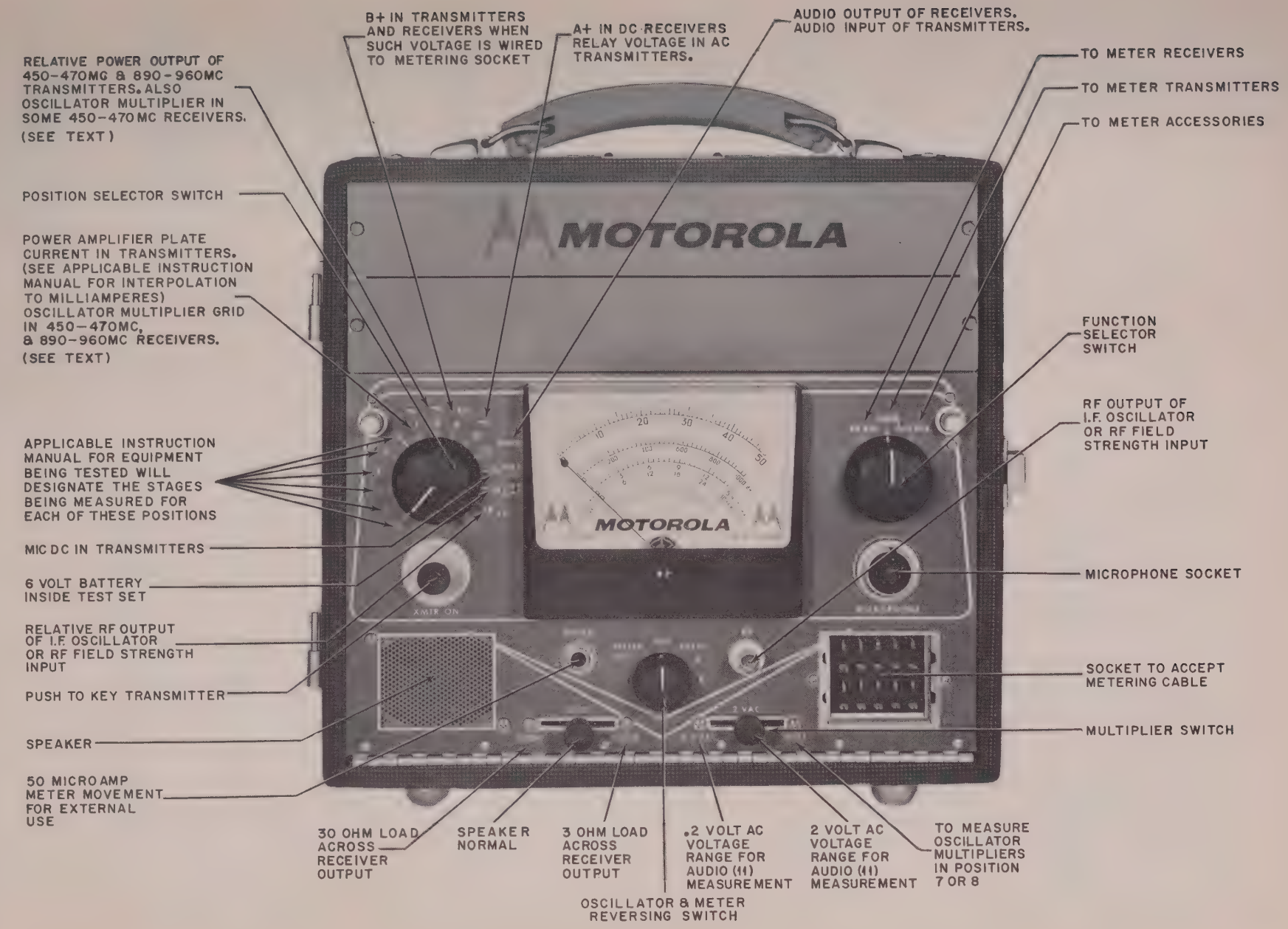
(1) Plug the 20-pin metering plug into the test set, to jumper pin #19 and #20.

(2) Place the Function Selector Switch in the XMTR position.

(3) Connect an a-c power source to pins #1 and #2 of the MICROPHONE receptacle on the front panel.

(4) Adjust the power source for 2 volts output measured with a voltmeter of known accuracy.

(5) Adjust the meter calibration control until the meter (bottom scale) indicates 2 volts full scale.


B+ IN TRANSMITTERS AND RECEIVERS WHEN SUCH VOLTAGE IS WIRED TO METERING SOCKET
A+ IN DC RECEIVERS RELAY VOLTAGE IN AC TRANSMITTERS.
AUDIO OUTPUT OF RECEIVERS. AUDIO INPUT OF TRANSMITTERS.
TO METER RECEIVERS
TO METER TRANSMITTERS
TO METER ACCESSORIES
RELATIVE POWER OUTPUT OF 450-470MG & 890-960MC TRANSMITTERS. ALSO OSCILLATOR MULTIPLIER IN SOME 450-470 MC RECEIVERS. (SEE TEXT)
POSITION SELECTOR SWITCH
POWER AMPLIFIER PLATE CURRENT IN TRANSMITTERS. (SEE APPLICABLE INSTRUCTION MANUAL FOR INTERPOLATION TO MILLIAMPERES) OSCILLATOR MULTIPLIER GRID IN 450-470MC, & 890-960MC RECEIVERS. (SEE TEXT)
FUNCTION SELECTOR SWITCH
RF OUTPUT OF I.F. OSCILLATOR OR RF FIELD STRENGTH INPUT
APPLICABLE INSTRUCTION MANUAL FOR EQUIPMENT BEING TESTED WILL DESIGNATE THE STAGES BEING MEASURED FOR EACH OF THESE POSITIONS
MIC DC IN TRANSMITTERS
6 VOLT BATTERY INSIDE TEST SET
MICROPHONE SOCKET
RELATIVE RF OUTPUT OF I.F. OSCILLATOR OR RF FIELD STRENGTH INPUT
PUSH TO KEY TRANSMITTER
SOCKET TO ACCEPT METERING CABLE
SPEAKER
MULTIPLIER SWITCH
50 MICRO AMP METER MOVEMENT FOR EXTERNAL USE
30 OHM LOAD ACROSS RECEIVER OUTPUT
SPEAKER NORMAL
3 OHM LOAD ACROSS RECEIVER OUTPUT
.2 VOLT AC VOLTAGE RANGE FOR AUDIO (11) MEASUREMENT
2 VOLT AC VOLTAGE RANGE FOR AUDIO (11) MEASUREMENT
TO MEASURE OSCILLATOR MULTIPLIERS IN POSITION 7 OR 8
OSCILLATOR & METER REVERSING SWITCH
MOTOROLA
MOTOROLA
XMTR ON

Controls Location Detail
Motorola No. BEPD-1116-A
3/7/61-UM

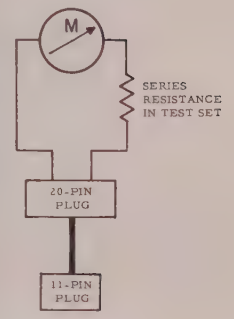
METERING CHART

MODELS TU546 & TU546P PORTABLE TEST SET

(TO BE USED WITH THE METERING PROCEDURES DESCRIBED IN THE INSTRUCTIONS SUPPLIED WITH THE RECEIVER AND TRANSMITTER)

	FUNCTION SELECTOR SWITCH RCVR. POSITION (SEE NOTE 3)					FUNCTION SELECTOR SWITCH XMTR. POSITION (SEE NOTE 4)					FUNCTION SELECTOR SWITCH ACCESS. POSITION
			SEE SIMPLIFIED METER CIRCUIT DETAIL					SEE SIMPLIFIED METER CIRCUIT DETAIL			
	POSITION OF POSITION SELECTOR SWITCH	CIRCUIT METERED IN MOTOROLA RECEIVERS	METER SCALE	CONNECTIONS AT 20-PIN PLUG ON FRONT PANEL	CONNECTIONS AT 11-PIN PLUG	RESISTANCE IN TEST SET IN SERIES WITH 50UA, 2000Ω METER	CIRCUIT MEASURED IN MOTOROLA TRANSMITTERS	METER SCALE	CONNECTIONS AT 20-PIN PLUG ON FRONT PANEL	CONNECTIONS AT 11-PIN PLUG	RESISTANCE IN TEST IN SERIES WITH 50UA, 2000Ω METER	THE ACCESS POSITION IS USED TO PLACE THE METER INTO THE PEAKING GENERATOR CIRCUIT, IF USED WITH THE TEST SET
1	Grid of Last IF Stage	0-50 ua	1 & 11	1 & 11	18K ± 2%	Same as Position 8	0-50 ua	1 & 11	1 & 11	18K ± 2%	
2	Grid of 1st Limiter	0-50 ua	2 & 11	2 & 11	18K ± 2%	Osc. or Tripler Except in 25-54 Mc and Some 144-174 Mc	0-50 ua	2 & 11	2 & 11	18K ± 2%	
3	See Alignment Chart	0-50 ua	3 & 11	3 & 11	18K ± 2%	Doubler Except Not used in 25-54 Mc Xmtrs.	0-50 ua	3 & 11	3 & 11	18K ± 2%	
4	Discriminator Output	20-0-20 ua	4 & 11	4 & 11	18K ± 2%	Doubler or Tripler	0-50 ua	4 & 11	4 & 11	18K ± 2%	
5	Discriminator Input	0-50 ua	5 & 11	5 & 11	18K ± 2%	Doubler or Tripler	0-50 ua	5 & 11	5 & 11	18K ± 2%	
6	See Alignment Chart	0-50 ua	6 & 11	6 & 11	18K ± 2%	Grid of Power Amplifier	0-50 ua	6 & 11	6 & 11	18K ± 2%	
7	Multipliers in 450-470 Mc & 890-960 Mc Rcvrs	0-50 ua	7 & 11	7 & 11	18K ± 2%	Power Amplifier Plate Current	See Alignment Chart	See Note 2 7 & 8	7 & 8	18K ± 2%	
8	Multiplier Switch in Mult. Position	0-50 ua	8 & 11	8 & 11	18K ± 2%	Relative Power Output of 450-470 Mc & 890-960 Mc Units	Relative 0-50 ua	1 & 11	1 & 11	18K ± 2%	
9	B+	0-1000 V	7 & 11	7 & 11	20 meg ± 2%	B+ to Power Amplifier Stages	0-1000 V	7 & 11	7 & 11	20 meg ± 2%	
10	Filament Voltage in DC Receivers Only	0-15 VDC	8 & 11	8 & 11	300K ± 2%	Push-to-Talk Voltage	0-15 VDC	9 & 11	9 & 11	300K ± 2%	
11	Audio Output of Receiver	See Note 1 0-2 VAC 0-.2 VAC	9 & 10	9 & 10	Transistorized AC Voltmeter	Audio Input To Transmitter	See Note 1 0-2 VAC 0-.2 VAC	10 & 11	10 & 11	Transistorized AC Voltmeter	
12	NONE	No Connection	No Connection	No Connection	No Connection	Microphone DC Voltage	0-30 VDC	10 & 11	10 & 11	600K ± 2%	
13	Test Set Battery Check	0-15 V	13 & 19	No Connection	300K ± 2%	Test Set Battery Check	0-15 VDC	See Note 5 13 & 19	No Connection	300K ± 2%	
14	RF Output of IF Oscillator or Fld. Stgth. Input	Relative 0-50	No Connection	No Connection	RF Diode Detector 18K ± 2%	RF Output of IF Oscillator or Field Strength Input	Relative 0-50	No Connection	No Connection	RF Diode Detector 18K ± 2%	
15	Spare	0-50 ua	15 & 11	No Connection	18K ± 2%	Spare	0-50 ua	15 & 11	No Connection	18K ± 2%	

SIMPLIFIED METER CIRCUIT DETAIL



NOTES:

1. The MULT switch changes the range from 2 VAC full scale to .2 VAC full scale, ±10% -5°C to +60°C (-30% at - 30°C)
2. To obtain PA current reading, the transmitter must be keyed by the XMTR ON switch. The Microphone push-to-talk switch can be used for all other transmitter metering.
3. When measuring receivers, the function selector switch must be in the RCVR position and the metering cable connected to the test set and receiver.
4. When measuring transmitters, the function selector switch must be in the XMTR position and the metering cable connected to the test set and transmitter.
5. In the 20-pin plug pin #19 and #20 are connected together. This completes the battery circuit when the 20-pin plug is connected to the test set.

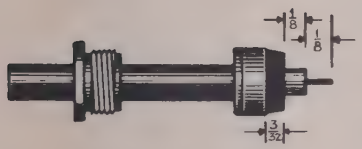
TYPE BNC
CONNECTOR ASSEMBLY INSTRUCTIONS

EPD-1140

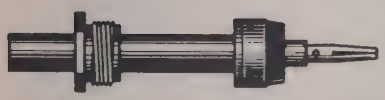
Trim jacket ¼" for RG-58/U, 5/16" for RG-59/U or 7/16" for RG-71/U.

Fray shield and strip inner dielectric ⅛". Tin center conductor.

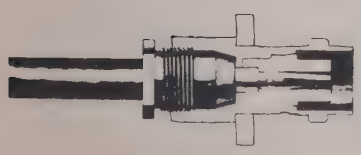
Taper braid and slide nut, washer, gasket and clamp over braid. Clamp is inserted so that its inner shoulder fits squarely against end of cable jacket.



With clamp in place, comb out braid, fold back smooth as shown and trim 3/32" from end.



Slip contact in place, butt against dielectric and solder. Remove excess solder from outside of contact. Be sure cable dielectric is not heated excessively and swollen so as to prevent dielectric from entering into connector body.



Push assembly into body as far as it will go. Slide nut into body and screw in place with wrench until tight. For this operation, hold cable and shell rigid and rotate nut.

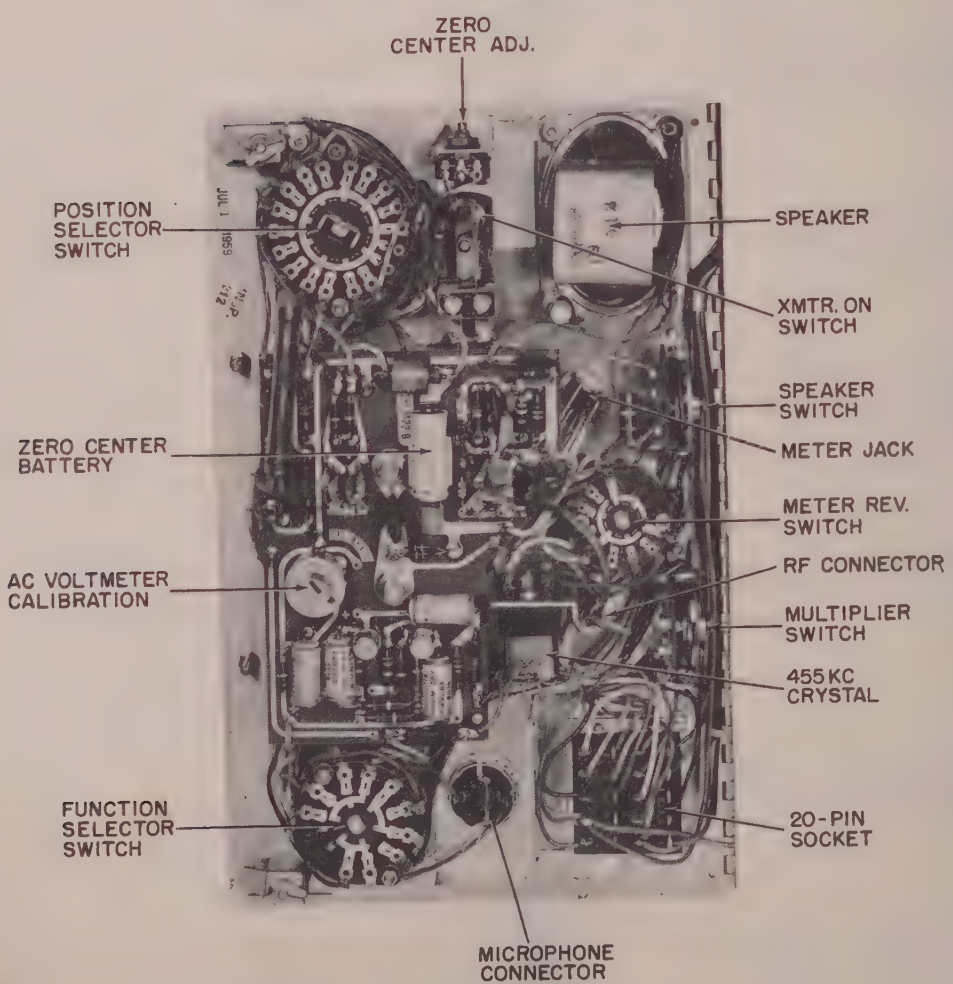
RF PROBE EXTENSION CABLE

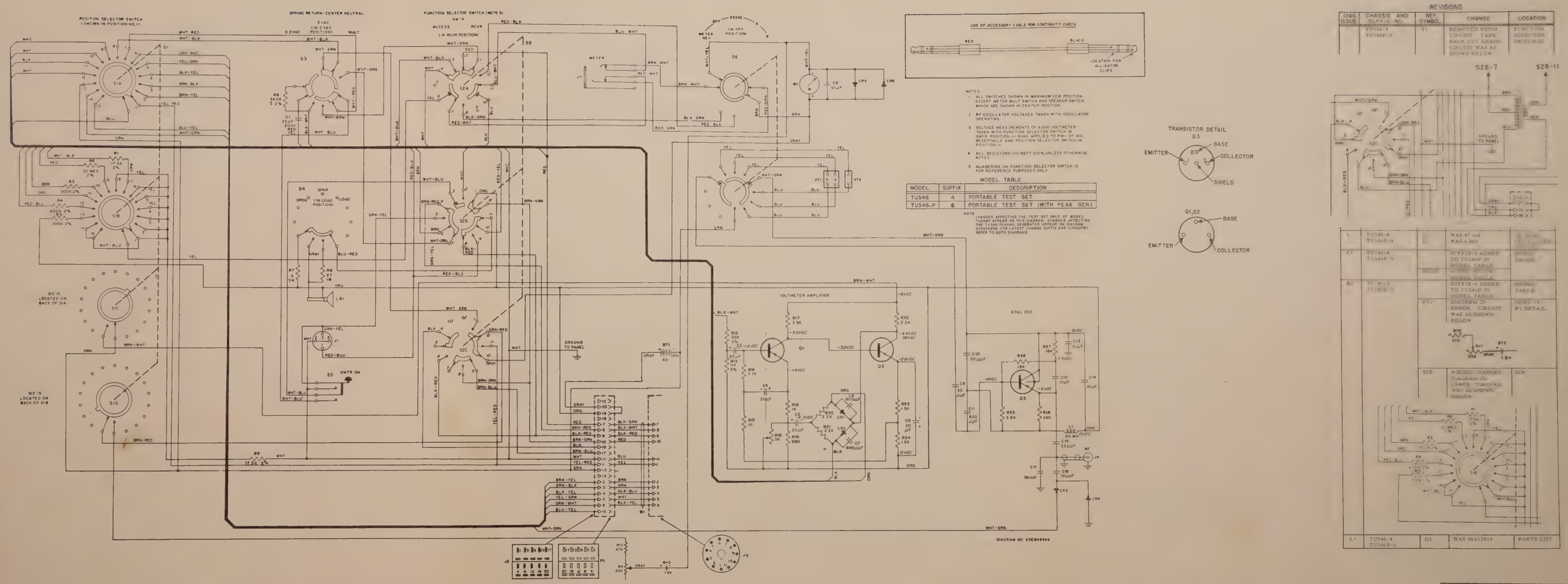
RF PROBE CABLE

ACCESSORY CABLE

ADAPTER FOR RF PROBE EXTENSION CABLE

REAR VIEW OF FRONT PANEL




POSITION SELECTOR SWITCH (SHOWN IN POSITION NO. 1)
SPRING RETURN-CENTER NEUTRAL
FUNCTION SELECTOR SWITCH (NOTE 5)
S1
S2
S3
S4
S5
S6
S1A
S1B
S1C
S1D
S2A
S2B
S2C
S4A
S4B
S1C IS LOCATED ON BACK OF S1A
S1D IS LOCATED ON BACK OF S1B
METER
XMTR ON
GROUND TO PANEL
VOLTMETER AMPLIFIER
XTAL OSC
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q17
Q18
Q19
Q20
Q21
Q22
Q23
Q24
Q25
Q26
Q27
Q28
Q29
Q30
Q31
Q32
Q33
Q34
Q35
Q36
Q37
Q38
Q39
Q40

PARTS LIST for Diagram 63E849846-E3

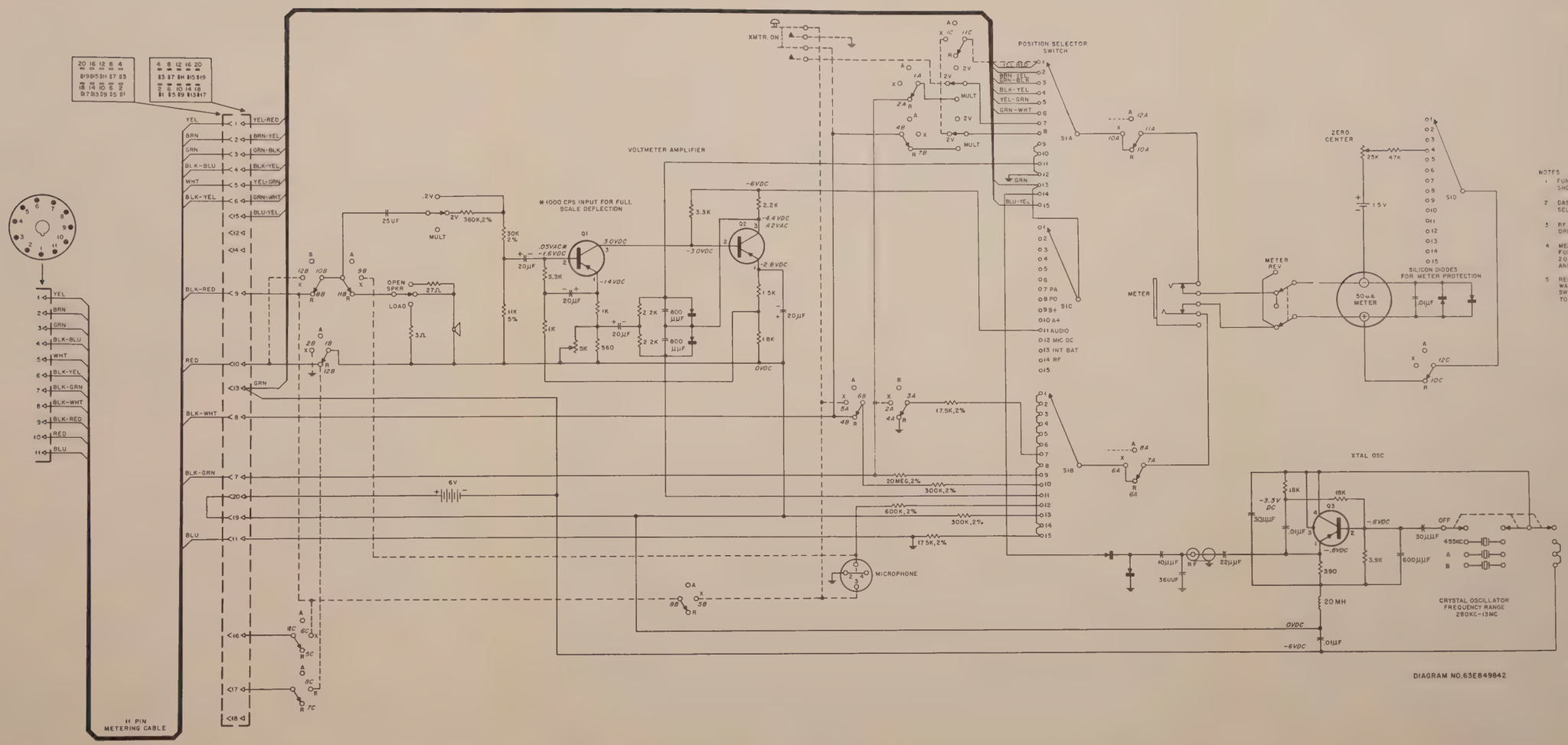
REFERENCE SYMBOL	MOTOROLA PART No	DESCRIPTION
		BATTERY, dry:
BT1	60B852116	1-1/2 volt, "D" size cell; 4 req'd
BT2	60B855262	1-1/2 volt; "N" size cell
		CAPACITOR, fixed:
C1	8K834384	metallized paper, tubular; .25 uf ±20%; 200 vdcw
C2	21B801139	ceramic, disc; .01 uf; +80-20%; 600 vdcw
C3	23C855013	electrolytic; tubular; 20 uf +100-10%, 25 vdcw
C4		same as C3
C5		same as C3
C6	21B847070	ceramic, disc, 800 uuf ±10%, 600 vdcw
C7		same as C6
C8		same as C3
C9	21R114166	ceramic, disc; 30 uuf ±10%, 500 vdcw
C10		same as C9
C11	21K851299	ceramic, disc; 600 uuf ±10%; 600 vdcw
C12		same as C2
C13		same as C2
C14		same as C2
C15	21R124554	ceramic, disc; 22 uuf ±5%, 500 vdcw
C16	21R410063	ceramic; disc; 10 uuf ±5%; 500 vdcw
C17	21K852185	ceramic; disc; 36 uuf ±5%; 500 vdcw
		CRYSTAL UNIT, rectifying:
CR1	48C847274 or 48K861552	germanium
CR2		same as CR1
CR3		same as CR1
CR4		same as CR1
CR5	48B857965	silicon
CR6		same as CR5
		CONNECTOR, receptacle:
J1	9B16345	female; 4 contact, polarized; round molded phenolic insulator; chassis mounted
J2	28B855267	male; 20 contact; polarized; rectangular molded black phenolic insulator; saddle mounted
		JACK, telephone:
J3	9B855279	contact arrangement of stacks, 2 form "B"
		CONNECTOR, receptacle:
J4	9B855268	female; single contact; round molded insulator; 50 ohm impedance; chassis mounted
		COIL, RF:
L1	24B801876	choke, 20 millihenries, coded BLUE dot
		SPEAKER, magnetic:
LS1	50C855098	voice coil impedance, 3.2 ohm; power rated at 3 watt; PM type; 2" x 3"
		METER, multi-scale:
M1	72D855099	panel mounted; consists of 20-0-20, 0-50 ua, 0-1000 VDC, 0-15 VDC, 0-30 VDC, 0-2 VAC
		CONNECTOR, plug:
P1	9B855266	female; 20 contact; polarized, rectangular molded black phenolic insulator; cable mounted

REFERENCE SYMBOL	MOTOROLA PART No	DESCRIPTION
		CONNECTOR, plug:
P2	28B813576	male; 11 contact; polarized; round molded black phenolic insulator; does not include 1V858293 SHELL, connector and handle and 41A483715 SPRING, connector shell retainer; shell and spring must be ordered separately
		TRANSISTOR:
Q1	48A124326	p-n-p
Q2		same as Q1
Q3	48A124321	p-n-p
		RESISTOR, fixed: carbon; unless otherwise stated
R1	6K855337	carbon film; 17.5K ±2%; 1/2 w; ins.
R2	6K892455	carbon film; 20 megohm ±2%; 2 w; ins.
R3	6K855329	carbon film; 300K ±2%; 1/2 w; ins.
R4	6K855330	carbon film; 600K ±2%; 1/2 w; ins.
R5		same as R3
R6	6K855332	carbon film, 360K ±2%; 1/2 w; ins.
R7	17K82839	wire-wound; 3 ohm ±10%, 5 w; ins.
R8	6R5676	27 ohm ±10%; 1 w; ins.
R9		same as R1
R10	6R6048	47K ±10%; 1/2 w; ins.
R11	18K848202	variable; carbon; 25K ±20%; .2 watt
R12	6K855331	carbon film; 30K ±2%; 1/2 w; ins.
R13	6R115017	11K ±5%; 1/2 w; ins.
R14	6R5581	3.3K ±10%; 1/2 w; ins.
R15	6R6229	1K ±10%; 1/2 w; ins.
R16	18C855263	variable: wire-wound; 5K ±20%, 1 w
R17		same as R14
R18		same as R15
R19	6R6040	680 ohm ±10%; 1/2 w; ins.
R20	6R6069	2.2K ±10%; 1/2 w; ins.
R21		same as R20
R22		same as R20
R23	6R6038	1.5K ±10%; 1/2 w; ins.
R24	6R2089	1.8K ±10%; 1/2 w; ins.
R25	6R5659	3.9K ±10%, 1/2 w; ins.
R26	6R5591	18K ±10%; 1/2 w; ins.
R27		same as R26
R28	6R5554	390 ohm ±10%, 1/2 w; ins.
		SWITCH,
S1	40C855097	rotary; 2 section; continuous; non-shorting
S2	40B855095	rotary; 3 section; 3 position; non-shorting
S3	40B855094	lever; 1 section; 3 position; non-shorting
S4	40B855096	lever; 1 section; 3 position shorting
S5	40C848230	push; contact arrangement; 2 form "A"; non-locking
S6	40B855093	rotary; 2 section; 5 position; non-shorting
		CABLE ASSEMBLY, special purpose:
W1	1V858292	Metering: includes: 30B474498 CABLE, special purpose: 12 conductor;

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CABLE ASSEMBLY, special purpose: rubber covered; 50" length required 10M519 WIRE, electrical: single conductor; "24 ga. sol.; 1" required Reference parts P1, P2
		SOCKET, crystal:
XY1	9K857508	female; 4 contact; square molded black bakelite base; chassis mounted
XY2	9K857509	female; 2 contact; rectangular molded black bakelite base; chassis mounted

MISCELLANEOUS NON-REFERENCED PARTS LIST

	13A855076	GRILLE, speaker
	36A855276	BUTTON, lever: 2 required; for reference parts S3, S4
	36A855070	KNOB, control: 2 required; for reference parts S1, S2
	36A855071	KNOB, control: for reference part S6
	42B861758	HOLDER, battery
	55A855264	FASTNER, adjustable pawl: R.H.
	55K855265	FASTNER, adjustable pawl: L.H.
	48K844891	CRYSTAL UNIT, quartz: 455 kc; type AQL
	58B855270	ADAPTER: UHF to BNC
	1V855413	ACCESSORY CABLE ASSEMBLY: includes: 30A76858 CABLE, special purpose: 2 conductor; rubber covered; 4 ft. length required 28A855277 PLUG, telephone: black handle 28K855278 PLUG, telephone: red handle
	1V855414	RF TEST LEAD ASSEMBLY: includes: 30B475378 CABLE, RF: coaxial; RG-58A/U; 4 ft. length req'd. 28B844876 CONNECTOR, plug: single contact; 2 required
	1V855415	RF PROBE ASSEMBLY: includes: 30B475378 CABLE, RF: coaxial; RG-58A/U; 1 ft. length req'd 9B855269 JACK, telephone


REVISIONS
DIAG ISSUE | CHASSIS AND SUFFIX NO. | REF. SYMBOL | CHANGE | LOCATION
REFERENCE SYMBOLS ADDED
NOTES
1 FUNCTION SELECTOR SWITCH(RCVR XMTR ACESS) SHOWN IN RCVR POSITION
2 DASHED LINES INDICATE CIRCUITRY WHEN FUNCTION SELECTOR SWITCH IS IN XMTR POSITION
3 RF OSCILLATOR VOLTAGES TAKEN WITH OSCILLATOR OPERATING
4 MEASUREMENTS OF AUDIO VOLTMETER TAKEN WITH FUNCTION SELECTOR SWITCH IN XMTR POSITION, 2.0 VAC APPLIED TO PIN 1 OF MICROPHONE RECEPTACLE AND SWITCH 1 IN POSITION 11
5 REFERENCE NUMBERS ON R-X-A SWITCH REFER TO WAFER SWITCH SECTIONS OF THE FUNCTION SELECTOR SWITCH ON CIRCUIT DIAGRAM 63E849846 & REFERS TO WAFER SECTION S2A, TERMINAL 6
TRANSISTOR DETAIL
Q1 & Q2
EMITTER
BASE
RED DOT
COLLECTOR
Q3
EMITTER
BASE
COLLECTOR
INTERLEAD SHIELD METAL CASE
POSITION SELECTOR SWITCH
VOLTMETER AMPLIFIER
* 1000 CPS INPUT FOR FULL SCALE DEFLECTION
XMTR ON
ZERO CENTER
METER REV
METER
50 MA METER
SILICON DIODES FOR METER PROTECTION
XTAL OSC
MICROPHONE
OPEN SPKR
LOAD
MULT
11 PIN METERING CABLE
CRYSTAL OSCILLATOR FREQUENCY RANGE 280KC-13MC
DIAGRAM NO. 63E849842

Portable Test Set
Simplified Circuit Diagram
Motorola No. 63E849842-F1
3/7/61-UM

PEAKING GENERATOR

MODEL TK589

AEPD-6126-O(CE920A)

TK589 Peaking Generator Mounted in TU546 Portable Test Set

1. DESCRIPTION

The Model TK589 Peaking Generator is a crystal-controlled signal source which provides r-f signals ranging from 4 mc to 960 mc. The generator is used for peaking of the r-f stages of f-m communications receivers operating within the 4 to 960 mc range and also provides normally encountered intermediate frequencies for alignment of receiver i-f stages.

The peaking generator essentially consists of a transistorized oscillator, internal and external crystal sockets, tuned circuits and front mounted controls and switches. It requires a separate 6 volt d-c power source. The transistorized oscillator will operate properly only with anti-resonant crystals.

The generator is designed for mounting in the same housing as the TU546 Portable Test Set. When mounted in the test set housing, the generator uses the battery supply built into the test set.

If the test set is used at one location and the generator is required at another location, the generator may be removed from the test set housing. A metal cover, which is part of the generator, protects the generator components when it is removed from the test set housing. To provide operating voltages, the generator can then be connected to any 6 volt d-c battery.

2. INSTALLATION

a. Portable Test Set

The front panel of the TU546 Portable Test Set has two removable panels. The open partition provided by removal of the lower panel is for mounting the peaking generator.

Open the front of the test set. Insert the four wires through the hole in the corner of the partition and then through the same sleeving as the battery wires. Connect the four wires from the generator to the test set as follows:

(1) Connect the black-green wire to the black-green wire on the METER REV switch.

(2) Connect the red-black wire to the red-black wire on the METER REV switch.

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Engineering Publications 4501 W. Augusta Blvd. Chicago 51, Illinois

(3) Connect the orange wire to pin #19 on the 20-pin receptacle.

(4) Connect the green wire to pin #13 on the 20-pin receptacle.

b. Separate Mounting

If the peaking generator is to be installed in any place other than in the portable test set housing, make the electrical connections as follows:

(1) Connect the black-green wire from the generator to the positive terminal of a 50 microampere meter.

(2) Connect the red-black wire to the negative terminal of a 50 microampere meter.

(3) Connect the green wire to the negative terminal of a 6 volt d-c source.

(4) Connect the orange wire to the positive terminal of the 6 volt d-c source.

3. CONTROLS

a. CRYSTAL

The CRYSTAL switch is a 9 position switch located on the front of the generator. Positions 1 through 8 correspond to eight numbered internal crystal positions, which permit selection of up to eight test frequencies.

The EXT. position on the switch selects the three external crystal sockets. Only one crystal should be used at a time when using the EXT. position.

An anti-resonant, ovenized transmitter control crystal may be used without using the crystal heater.

b. SET LEVEL and ATTENUATOR

Operation of the SET LEVEL and ATTENUATOR varies the amount of oscillator current, which also controls the output level of the generator.

CAUTION

Some frequency shift may be encountered with adjustment of the SET LEVEL or ATTENUATOR.

The ATTENUATOR is a smaller adjustable resistance which is useful in adjusting the output of the 890-960 mc tuned circuit to a pre-determined level and also for making fine adjustments of the SET LEVEL. Both controls are labeled from 0 to 10. This labeling enables re-setting of the controls after they have been checked against a signal generator of known accuracy or against the diode current reading indicated on the portable test set meter.

c. FREQ. ADJUST

The FREQ. ADJUST control provides fine tuning correction (warping) of the crystal frequency. This control should be used only to "zero" the crystal frequency. It is important to note that a change in frequency may cause a change in the output level.

d. RANGE

Operation of the RANGE switch selects a warping circuit for a range of crystal frequencies and also selects the proper output circuit to correspond to the frequency range.

Position A - Not used

Position Low - crystals from 4 to 8 mc. This position provides a useful harmonic output up to 470 mc for alignment of receivers in the 25 to 470 mc range.

Position Hi. - crystals from 9 to 9.6 mc. This position provides a useful harmonic output from 890 to 960 mc.

To eliminate any low order harmonics which may be encountered in any of the intermediate frequency bands, when using positions B or C, the crystals available for use with the peaking generator are specially selected to prevent low order harmonic interference. An example of this is as follows: channel frequency - 33 mc; crystal used - 2.750 mc. If this crystal is used in the peaking generator and the receiver being tested has a first i-f of 5.5 mc, then the second harmonic of the crystal (2 x 2.750 mc = 5.5 mc) may interfere during the r-f alignment.

When using transmitter crystals, the possibility of i-f interference should be considered.

4. CALIBRATION

The peaking generator can be checked against a signal generator of known accuracy using an f-m communications receiver as a tuned voltmeter.

a. Meter Discriminator and Limiter -- connect the metering cable from the test set to the receiver.

b. Interconnect Signal Generator and Radio Set -- connect the r-f probe from the signal generator to the antenna receptacle on the radio set.

c. Zero Signal Generator Frequency -- set the signal generator to the exact receiver frequency.

d. Adjust Signal Generator Output -- adjust output to approximately 1 microvolt. Note the limiter reading (Position Selector switch in position #2).

e. Replace Signal Generator with Peaking Generator -- remove the signal generator cable and connect the peaking generator r-f cable to the antenna receptacle on the radio set.

f. Adjust Frequency to Exact Receiver Frequency -- place the Position Selector switch in position #4. Adjust the frequency output of the peaking generator to the exact receiver frequency.

g. Adjust SET LEVEL and/or ATTENUATOR -- adjust the SET LEVEL and/or ATTENUATOR for the same limiter reading as in step d. above. Recheck the FREQ. ADJUST. Record the exact position of the SET LEVEL and ATTENUATOR controls to eliminate the above procedures in subsequent receiver checking.

5. OUTPUT CIRCUITS

There is an adjustable capacitor in each output circuit. One circuit is peaked at approximately 460 mc (C1 on Schematic Diagram 63C852859) and needs no further adjustment. The other circuit is peaked between 890-960 mc (C2 on Schematic Diagram 63C852859) and should be peaked for maximum output on the test frequency.

6. OPERATING INSTRUCTIONS

General procedures for setting up the peaking generator for r-f peaking of an f-m communications receiver are as follows:

a. Rotate the CRYSTAL switch to select the crystal frequency to be used.

b. Place the RANGE switch in position ~~B~~ Lo or ~~C~~ Hi depending on the crystal fundamental frequency and the output frequency desired.

c. Adjust the SET LEVEL and the ATTENUATOR for the output level desired.

d. Rotate the FREQ. ADJUST to warp the crystal to the test frequency.

NOTE

When the Function Selector switch (on the TU546 Portable Test Set) is in ACCESS. position, the oscillator and harmonic diode generator efficiency can be checked by observing the test set meter reading. The normal maximum reading should not be less than 10 microamperes. The reading depends to some extent on the condition of the batteries and the condition of the crystal used. The batteries may be checked by placing the Position Selector switch on the test set to position #13 (Function Selector switch in RCVR or XMTR).

To conserve battery life, when the generator is not in use, place the SET LEVEL control in the full counterclockwise position, or 0. Under these conditions, the battery life is the same as the shelf life. The batteries are completely removed from the peaking generator circuit when the 20-pin metering plug is not plugged into the 20-pin receptacle on the test set.

7. CRYSTALS

Crystals are not supplied with the peaking generator, but are available on separate order. R-F outputs ranging in frequency from 4 to 960 mc are produced from crystals which range in frequency from 4 to 9.6 mc. The frequency of the crystal required to produce the desired r-f output must be calculated from the formulas given in Table 1. In general, any anti-resonant type transmitter crystal may be used if the frequency is correct.

A maximum of 9 crystals may be plugged into the 8 internal sockets and 3 external sockets (only one of the external sockets may be used at a time because all three are connected in parallel). The 8 internal sockets and one of the external sockets (XY5) will accept ANL or AUL type crystals. Another external socket (XY6) accepts SFMT type crystals, and the remaining external socket (XY7) takes AN type crystals. After calculating the crystal frequency by using Table 1, the crystal type may be selected from Table 2. It is usually advantageous to choose an ANL or AUL type since these types fit in either the internal or external sockets. When ordering, give both the type and frequency of the crystal desired.

TABLE 1

Crystal Calculations for TK589 Peaking Generator

Fc = Desired generator output frequency
Fx = Crystal Frequency required

Fc	Fx	Fc	Fx	Fc	Fx	Fc	Fx
4-8 mc	$Fx = Fc$	48-54 mc	$Fx = \frac{Fc}{8}$	134-141 mc	$Fx = \frac{Fc}{19}$	407-423 mc	$Fx = \frac{Fc}{54}$
8-15 mc	$Fx = \frac{Fc}{2}$	54-65 mc	$Fx = \frac{Fc}{9}$	141-147 mc	$Fx = \frac{Fc}{20}$	423-438 mc	$Fx = \frac{Fc}{56}$
25-30 mc	$Fx = \frac{Fc}{4}$	65-72 mc	$Fx = \frac{Fc}{10}$	147-154 mc	$Fx = \frac{Fc}{21}$	438-452 mc	$Fx = \frac{Fc}{58}$
30-36 mc	$Fx = \frac{Fc}{5}$	72-80 mc	$Fx = \frac{Fc}{11}$	154-161 mc	$Fx = \frac{Fc}{22}$	452-470 mc	$Fx = \frac{Fc}{60}$
36-42 mc	$Fx = \frac{Fc}{6}$	80-90 mc	$Fx = \frac{Fc}{12}$	161-174 mc	$Fx = \frac{Fc}{23}$	890-920 mc	$Fx = \frac{Fc}{97}$
42-48 mc	$Fx = \frac{Fc}{7}$	127-134 mc	$Fx = \frac{Fc}{18}$	393-407 mc	$Fx = \frac{Fc}{52}$	920-960 mc	$Fx = \frac{Fc}{100}$

TABLE 2

Crystal Type Available and Their Frequency Range

Crystal Frequency	Motorola Type
2000-6000 kc	ANL and AN
6000-10000 kc	AUL
10000-13000 kc	ANL and AN

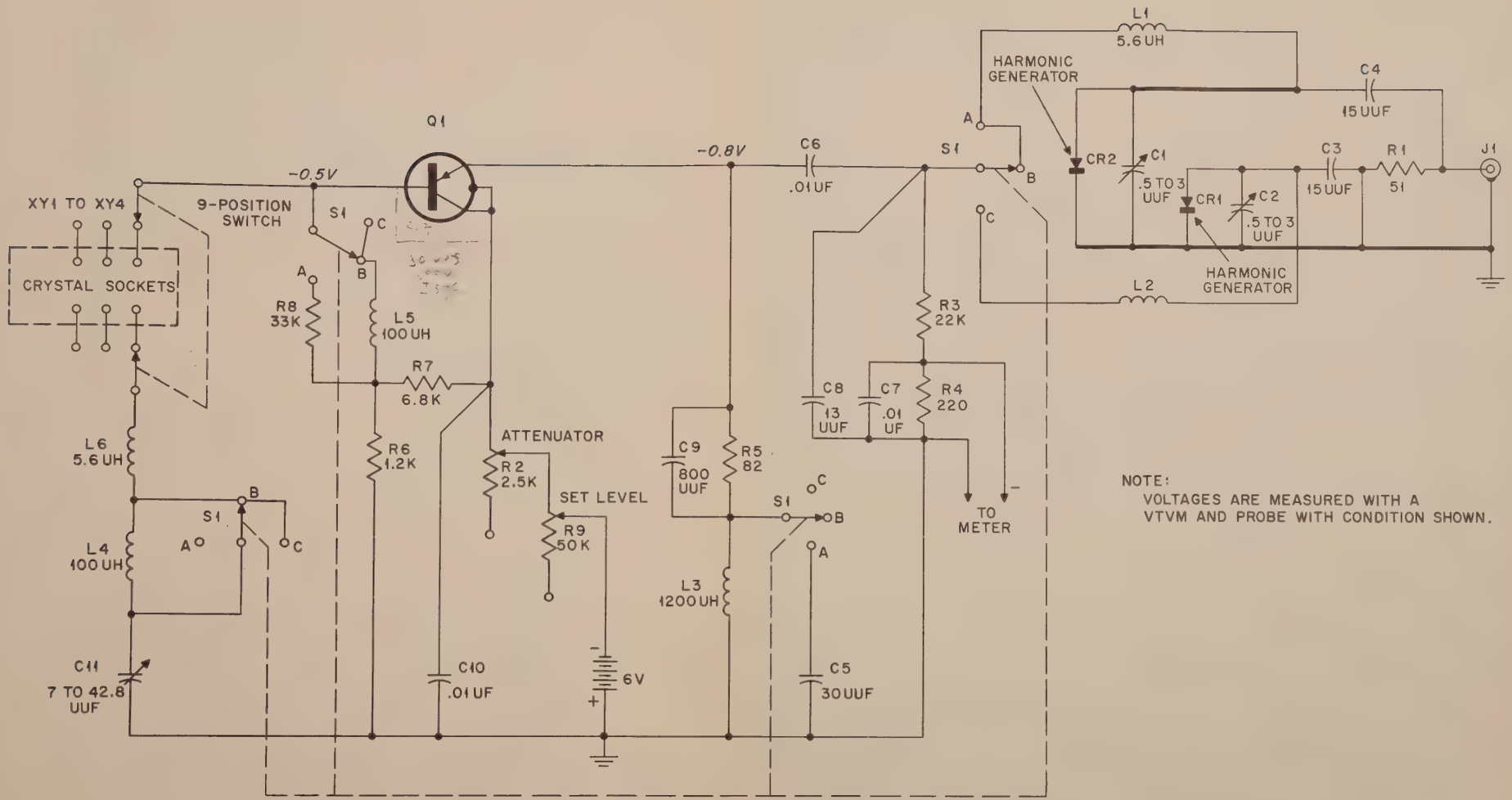
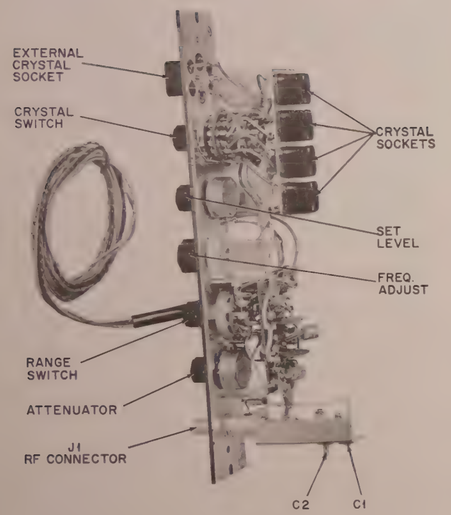


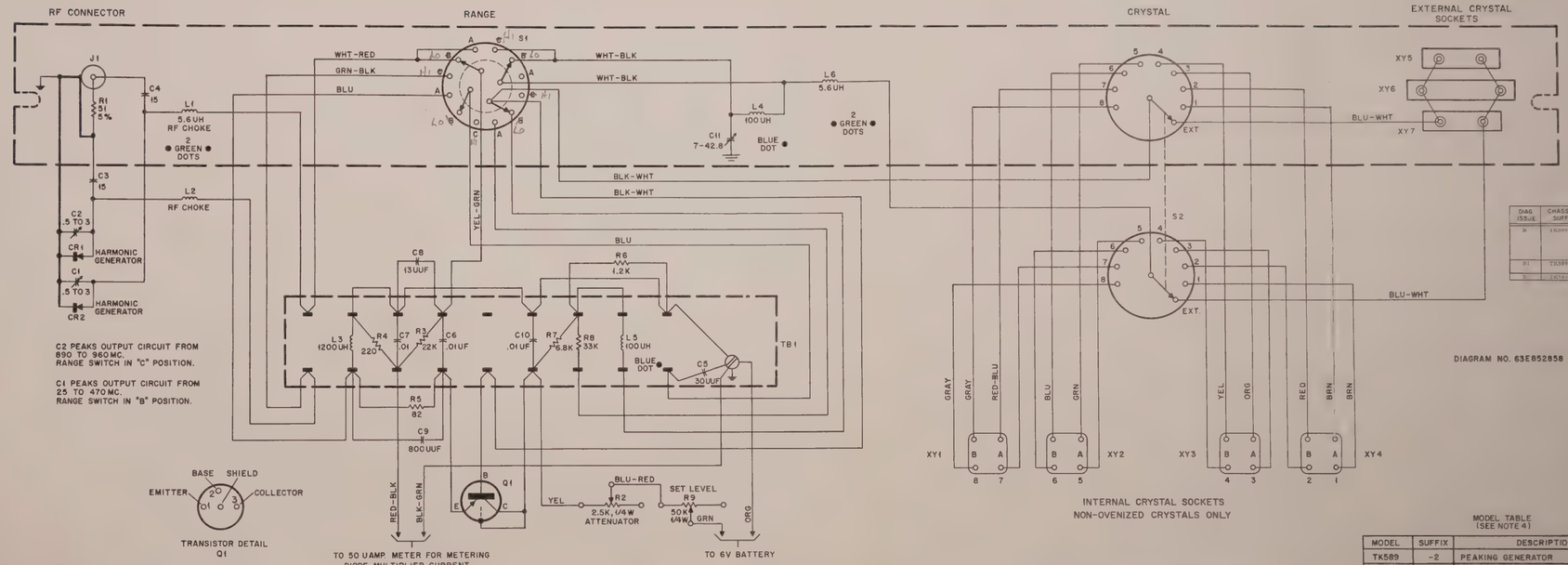
DIAGRAM NO. 63C852859

NOTE:
VOLTAGES ARE MEASURED WITH A VTVM AND PROBE WITH CONDITION SHOWN.

TK589 Peaking Generator
Simplified Circuit Diagram
Motorola No. 63C852859-C
3/7/61-UM

AEPD-2974-O (CE1701C)





REVISIONS

DIAG ISSUE	CHASSIS AND SUFFIX NO	REF. SYMBOL	CHANGE	LOCATION
b	180Y-4	A3	ADDED A3	
		L7	DELETED (620 mh)	
			ADDED (1.2 mh) WITH ADDED R8 (33K)	
		A4	ADDED A4	
b1	TK589-2	S31	S31 WAS CONNECTED RANGE TO A GROUND SCREW SWITCH	
b2	TK589-2	S31	S31 INCORR	

DIAGRAM NO. 63E852858

MODEL TABLE (SEE NOTE 4)

MODEL	SUFFIX	DESCRIPTION
TK589	-2	PEAKING GENERATOR
TU546P	-6	PORTABLE TEST (WITH PEAKING GENERATOR)

NOTES:
1. VOLTAGE READINGS TAKEN WITH ATTENUATOR AND SET LEVEL CONTROLS FULLY CLOCKWISE.
2. ALL RESISTORS ARE INDICATED IN OHMS, 1/2W, UNLESS OTHERWISE STATED.
3. ALL CAPACITORS ARE INDICATED IN MICROMICROFARADS UNLESS OTHERWISE STATED.
4. MODEL TK589 CHANGES APPEAR ON THIS DIAGRAM ONLY. CHANGES AFFECTING THE TEST SET PORTION OF THE MODEL TU546P APPEAR ON DIAGRAM 63E849846. FOR LATEST CHANGE SUFFIX AND CIRCUITRY REFER TO BOTH DIAGRAMS.

Model TK589 Peaking Generator
Wiring Diagram
Motorola No. 63E852858-B2
3/7/61-UM

PARTS LIST for Diagram 63E852858-B2

REFERENCE SYMBOL	MOTOROLA PART No.	DESCRIPTION
		CAPACITOR, fixed: unless otherwise stated
C1	20A858351	variable: air; 0.5 uuf min. to 3 uuf max.
C2		same as C1
C3	21K835358	molded silver mica; 15 uuf ±10%; 500 vdcw
C4		same as C3
C5	21R410048	ceramic; disc; 30 uuf ±10%; 500 vdcw
C6	21B801139	ceramic; disc; .01 uf +80-20%; 600 vdcw
C7		same as C6
C8	21K865358	ceramic; disc; 13 uuf ±5%; 500 vdcw
C9	21B847070	ceramic; disc; 800 uuf ±10%; 600 vdcw
C10		same as C6
C11	19A475604	variable: air; 7 uuf min. to 42.8 uuf max.
		CRYSTAL UNIT, rectifying:
*CR1	48B859427	germanium diode; coded yellow
*CR2		same as CR1
		CONNECTOR, receptacle:
J1	9B855268	female; single contact; round molded styrene insulator; 50 ohm impedance; type BNC; chassis mounted; RF Connector
		COIL, RF: choke;
L1	24A813564	5.6 uh; coded GRN-GRN
L2	24B858421	60 turns
L3	6R6397	1200 uh
L4	24A832402	100 uh; coded BLU
L5		same as L4
L6		same as L1
		TRANSISTOR:
Q1	48A124321	P-N-P; coded RED
		RESISTOR, fixed: carbon; unless otherwise stated
R1	6R5648	51 ohm ±5%; 1/2 w; ins.
R2	18K858468	variable; 2.5K ±30%; 1/4 w
R3	6R6397	22K ±10%; 1/2 w; ins
R4	6R6270	220 ohm ±10%; 1/2 w; ins.
R5	6R2035	82 ohm ±10%; 1/2 w; ins.
R6	6R6393	1.2K ±10%; 1/2 w; ins.
R7	6R6428	6.8K ±10%; 1/2 w; ins.
R8	6R6410	33K ±10%; 1/2 w ins.
R9	18K858469	variable: 50K ±20%; 1/4 w
		SWITCH, rotary:
S1	40K801196	4 pole; 3 position
S2	40B858122	2 pole; 9 position
		BOARD, terminal:
TB1	31A835961	18 solder lug terminals
		SOCKET, crystal: female;
XY1	9K857508	4 contact; square molded black bakelite base; chassis mounted
XY2		same as XY1
XY3		same as XY1
XY4		same as XY1
XY5	9K857509	2 contact, rectangular molded black bakelite base; chassis mounted
XY6	9K82810	SOCKET, (cont'd) 2 contact; rectangular molded black bakelite base; chassis mounted
XY7	9A824969	2 contact; rectangular molded steatite base; chassis mounted

*Germanium diodes, CR1 and CR2, are factory selected for proper 960 mc characteristics. Replacements for these items should only be ordered from a MOTOROLA parts depot as listed in the instruction manual. Order under the part number and nomenclature as listed above.

MOTOROLA

INSTRUCTION MANUAL REVISION MR-995

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

REVISION DETAILS

With this change the following becomes effective:

Instruction Manual No.	Peaking Generator Suffix	Schematic Diagram No.
68P849845-C	TU546P-7	63E849846-G
	TK589-3	63E852858-D

(1) Component Change

Ref. Sym.	Action	Part No.	Description
C12	Add	21K849335	CAPACITOR, fixed: 30 uuf ±5%; 500 v; N150 SEE WIRING CHANGE

(2) Wiring Change

Connect capacitor C12 between base and emitter of Q1 transistor.

Supplementary Remarks:

Simplified Diagram 63C852859 is affected with this change.

MOTOROLA

INSTRUCTION MANUAL REVISION T-966

GENERAL

This revision sheet outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

REVISIONS

With this change the following becomes effective:

Instruction Manual No.	Circuit Board Model No.	Circuit Board Diagram No.	Schematic Diagram No.	Change Item No.
68P868000-A			63E868001-AC 63E868002-AG	
68P868005-A			63E868006-AD 63E868007-AH	
68P868010-0			63E868011-AB	
68P868015-0			63E868016-AE	
	TLN6207A TLN6202A	EPD-5968 EPD-5973		1,2,3,4
68P868020-B			63E868021-AT 63E868022-AV	
68P868025-A			63E868026-AT 63E868027-AV	
68P868030-A			63E868031-AT	
68P868035-A			63E868026-AV	
68P81002A10-0			63E81002A11-E	
68P81002A15-0			63E81002A16-E	
68P81004A10-0			63E868022-AV	
68P81001A70-A			63E81001A71-T	
	TLN6220A	EPD-5904 EPD-6135		5,6,7,8,9
	TLN6219A	EPD-5909 EPD-6140		
68P81003A40-0	SLN6037A SLN6036A	(page 37) (page 39)	63E81003A41-A	10,11,12 13,14

Instruction Manual No.	Modular Assembly	Schematic Diagram No.	Change Item No.
68P862175-A	HI-IF-4	63E862176-F	15
68P81003A70-0	HI-IF-4	63E81003A71-C	15

Instruction Manual No.	Model	Schematic Diagram No.	Change Item No.
68P849845-C	TU546 Test Set	63E849846-F	16
	TU546P Test Set		16,17
	TK589 Peaking Generator	63E852858-C	17

Component Changes

Change Item No.	Ref. Sym.	Action	Part No.	Description
1	Q7	Change to	48R184546	TRANSISTOR: p-n-p; coded BLU
2	Q8	Change to		same as Change Item No. 1
3	Q9	Change to	48R134547	TRANSISTOR: p-n-p; coded WHT
4	Q10	Change to		same as Change Item No. 3
5	Q6	Change to		same as Change Item No. 3
6	Q7	Change to		same as Change Item No. 3
7	Q8	Change to		same as Change Item No. 3
8	Q9	Change to		same as Change Item No. 3
9	Q10	Change to		same as Change Item No. 3
10	Q10	Change to	48R134526	TRANSISTOR: p-n-p
11	Q11	Change to		same as Change Item No. 10
12	Q12	Change to		same as Change Item No. 10
13	Q14	Change to		same as Change Item No. 10
14	Q13	Change to		same as Change Item No. 10
15	Q2	Change to	48R134545	TRANSISTOR: p-n-p
16	Q3	Change to		same as Change Item No. 15
17	Q1	Change to		same as Change Item No. 15

Component Changes
(Cont'd)

Change Item No.	Ref. Sym.	Action	Part Number	Description
15	Q2	Change to	48R134545	TRANSISTOR: p-n-p
16	Q3	Change to		same as Change Item No. 15
17	Q1	Change to		same as Change Item No. 15

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INSTRUCTION MANUAL REVISION T-1189

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to correct your manual.

REVISION DETAILS

With this change the following becomes effective:

Instruction Manual No.	Peaking Generator Model & Suffix	Schematic Diagram No.
68P849845-C	TK589-2	63E852858-B2

Panel markings for the "RANGE" switch positions have been changed.

To make your instruction manual read correctly, make the following changes in the "PEAKING GENERATOR" section of the manual:

1) Omit any reference to Position "A".

2) Change "Position B" to read "LOW."

3) Change "Position C" to read "HI."

Section 68P852857-D -- "PEAKING GENERATOR" -- is affected as follows:

1) The photograph on page 1.

2) Paragraph 3.d. -- "RANGE"

3) Paragraph 6.b. ("OPERATING INSTRUCTIONS").

4) Diagram 63E852858-B2.

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